Analysis of the Impact of Green Music: A comparative study of the Effects of Fractal Music and Digital Music on the Human Mind/Brain

SHORT SYNOPSIS

Submitted in partial fulfillment of the requirement of the degree of

DOCTOR OF PHILOSOPHY

to

Manav Rachna University

by

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Year 2022

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ABSTRACT

At the point when the temperature of the Earth is at its most noteworthy of levels; when the atmosphere changes with no reasons; when the water enters into your safest territory. At the point when the creatures start getting homeless and the air is no more in its consumable level. These are not simply the conditions; these are the signs that we have to begin pondering the change. The refinement in our conduct towards nature, the refinement inside the utilization of darker vitality, the refinement inside the new made expectations for everyday comforts.

Going Green is the solution to these problems; Green Computing is one of them, it asks to adopt the method of Reuse, Renovation, Recycle and Reutilize. With the advancement of technologies not only the landfills, greenhouse gases and the digital signals are also increasing in a proportional manner.

Digital devices today emanate all kinds of unnatural signals. Since these signals are not normal in nature that is the reason, these signals are not assimilated normally on the earth and consequently these signals negatively affect the environment and the living things in this environment. These signals also affect the Human Brain/Mind.

To cure or to reduce the effect of these signals we must use the natural signals like the Fractal Signals.

Music has always been considered as the mode of relaxation and enjoyment. But the increase in the digitisation of music is bringing about a reverse effect.

Since music has always been a part of nature, be it a bird's humming or the sound of a flowing river. Music gives peace to the mind/brain. So to reduce the impact of the digitized music the use of music originating naturally must be increased.

Key words: Brain, Green Computing, Mind, Music, Signals.

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1. Introduction

1.1 Green Computing

The emergence of the industrial regime has increased the use of fossil-fuels and has thus resulted in endless harm to nature by increasing the emission of poisonous gases in the atmosphere. If this was not enough, advancement in IT industry and the increased usage of computers and other several devices started happening.

We failed to understand the harm that is being done by the blind usage of resources to the environment. Now it has become essential to look for eco-friendly approaches for a sustainable future. Looking for the options brought Green Computing into existence [2].

It required a significantly long investment to understand the damage that is occurring. It is our obligation today to understand the methodologies of saving nature for our economic future. Development, Innovation and Adaptation of green advances is the need of great importance.

PCs and a few different gadgets (counting tablets, cell phones and so on) are related with our everyday living. Every one of these gadgets devours a significant measure of vitality. The battery-life of the advanced cells is one of the related issues today.

Then again, short development cycles have expanded the obsolescence rate of these gadgets, which is adding to the disposal of electronic waste. In the year 2014, about 41.8 million metric tonnes of disposed-off electronic waste were produced all around the planet (Balde et al. 2015). The hazards related with managing this e-squander, call for green methods to be applied.

The electronic blast that we are seeing through the most recent decades has begun a humongous amount of unpleasant electronic items categorized as "e-waste". Electronic excess has been swelled lately, by 25–55 million tons annually. According to Greenpeace, if the estimated amount of disposed-of electronic waste generated each year were put in a train, it would be as long as the entire earth. It is an unimaginable damage to the earth as a result of the impermeable

electronic products' main components are made of hazardous synthetic materials and metals like lead, mercury, cadmium, and beryllium.

"The Energy Star Program" was launched by the American Environmental Protection Agency. The agency provides with “The Energy Star” tag to all electronic products which were successful in decreasing the consumption of energy while increasing its performance. A variety of products, including computer parts, televisions, and thermostatic equipment like refrigerators, air conditioners, and other like things, were covered by this classification. The sleep mode options of computer screens which keeps electronic hardware on backup mode when an already set time period gets over and no action is observed, was one of the major results of green processing [14].

Green Computing is an ongoing pattern and a developing field pointing towards a maintainable future. Diverse methodologies have been set up as conceivable headings towards green computing [11].

1.2 Motivation

Signals are an electromagnetic field or electric current which is used to convey information from one place to another.

Signals are either naturally generated or artificially generated from different sources.

Signals are broadly distributed in different spectrums; Digital Signals are one of them.

1.2.1 **Problems due to Digital Signals:**

A digital signal is a computerized signal in which first the data is changed into a series of bits before it gets transmitted.

Digital signals are artificially generated signals that are used to communicate data. These signals are used more or less in every domain for data communication.

Since these signals are not natural in nature that is why these signals are not absorbed naturally in the environment and thus these signals have adverse effects on the surroundings and on the living things in these surroundings.

These signals have become basic necessity in day to day life and are creating problems for human beings, specifically affecting the brain. It has shown various conceivable unfriendly impacts, particularly on cerebrum capacities, which have been of serious concern [1].

Some of the negative effects of these signals on human health and body:

- Brain Tumor
- Infertility
- Alzheimer
- Hearing Impairment
- Parkinson’s Disease
- Insomnia

2. Literature Review

Singing of the birds, the sound of the unlimited influxes of the ocean, the enchanted sound delivered by the minor drops of the rain falling on the rooftop, mumble of the trees, tunes, the entrancing sound created by the extended strings or the tap on the highest point of the melodic instruments, these all are sounds created by nature. To understand these sounds, one needs a mind to appreciate them [4].

Chaos theory has shown the new association amid human and the nature, where superficially arbitrary, processes that are tangled are described with particular inherent order. Using fractal techniques that is originally included in chaos theory, function fundamentally as a mathematical microscope, probing the depths of intricate EEG and audio signals with a level of resolution that no other approach can match. Using the fractal tools, seemingly random and disordered clear nonlinear signals can be observed.

A geometrical object called a fractal, that can be divided into fragments and is uneven or patchy, each part can be seen as its own reduced-size or the miniature of the entire. Typically, fractals are the objects that are self resembling and without any scales (a fractal measurement), which is an object's degree of roughness, brokenness, or irregularity. They are formed by repeatedly repeating a basic process in a continuous feedback loop. The fact that fractal objects' measured metric attributes, such length or area, depend on the scale of measurement, is one of their essential characteristics.

As we see Figure 1 more closely, there is one large triangle having three triangles halved in size from the original (side arm of triangle), these smaller triangles contain three smaller triangles and it continues so on. The Sierpinski triangle is an illustration of an item that is self-similar [16][18][29][30].

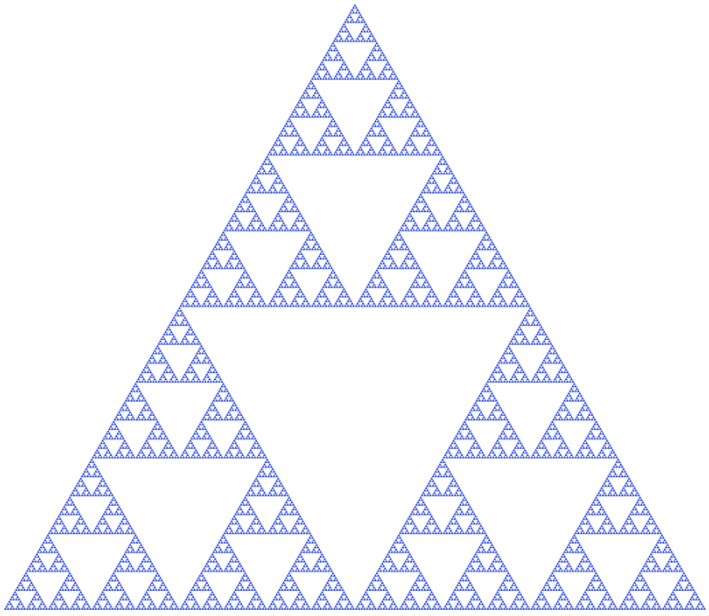

Figure 1. The Sierpenski triangle [18]

Similarly, Human brain is described as one of the most frenzy organ in the universe, and most amazing part is that it is organized only by the chaos. Fractals are known as human's instant connection with nature as shown in Figure 2. Field of fractal geometry was developed by (Mandelbrot 1977), that played a major role in the emergence of chaos theory [24][25][28].

Figure 2. Human Brain as Fractal [21]

The human brain functional network illustrated in Figure 3, is a small scale fractal architecture which enables the understanding of while maintaining global topological characteristics, the hazardous dynamics and task-related spatial reconfiguration.

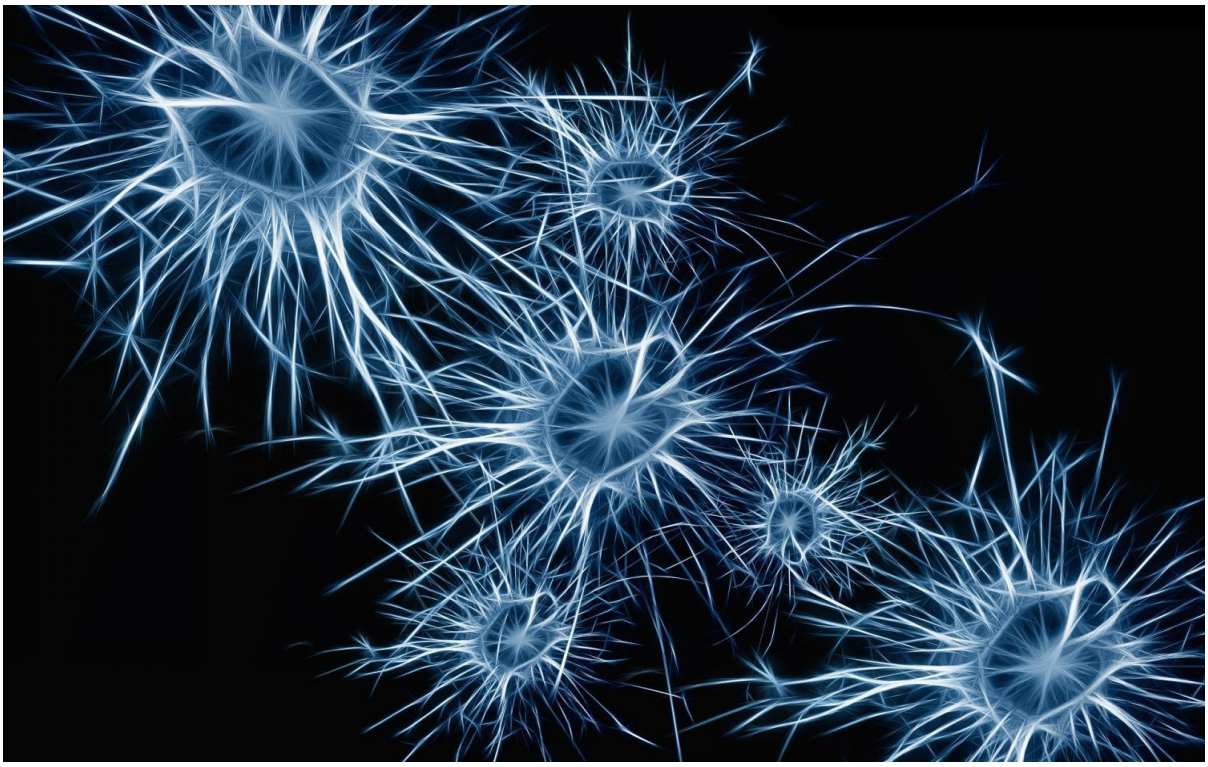

Figure 3. Neurons in Human Brain [20]

As shown in Figure 4, the Human brain is collection of chambers, each chamber works on processing its own information. It is considered as a self-organizing structure working closely on instabilities where its activities are governed by collective variables, the order parameters, which bind the individual portions, i.e., the neurons.[17]

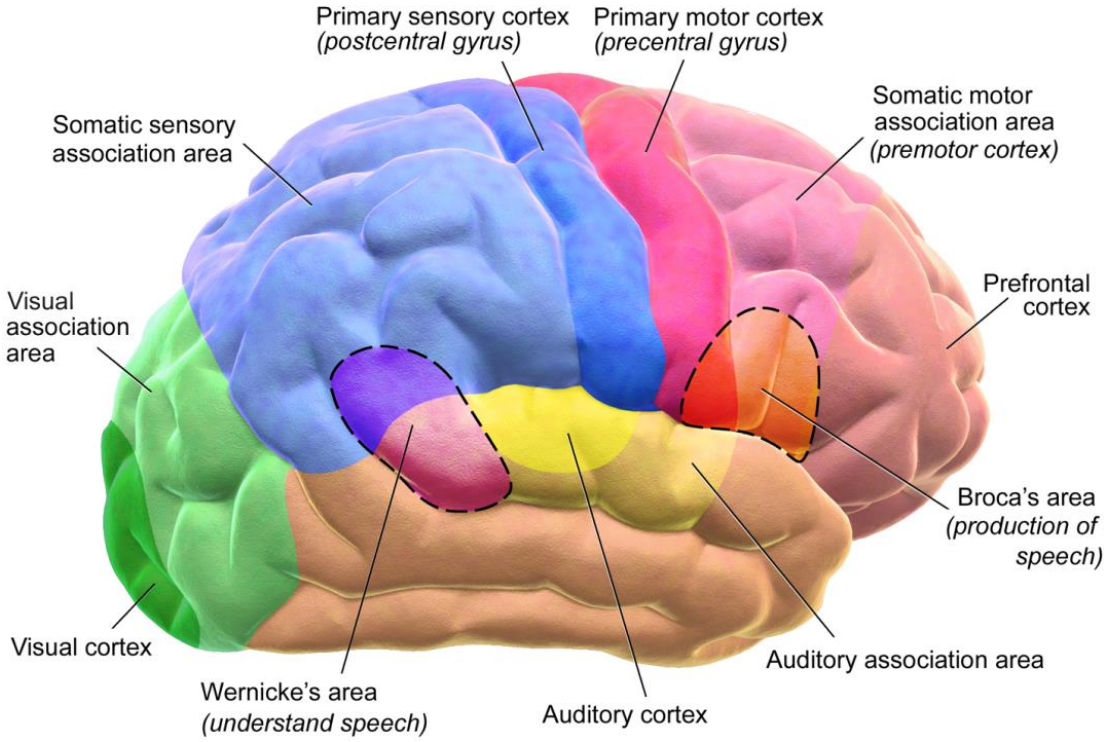

Figure 4. Human- Brain Structure [19]

Music holds the capacity of capturing most of the brain. Music binds the mind emotionally and generates an extensive variety of preparing components. This normally welcomes consideration of how music perception may identify with other composite psychological capacities. The epic capacity that music possesses so as to influence and control feelings and the mind, is obvious, but then to a great extent unknown.

The human cerebrum, which is a standout amongst the most complex natural structures, includes billions of consolidated physiological strategies that offer a view of neuro-electrical activities, using an electroencephalogram (EEG). Music can be viewed as a contribution to the mind framework which impacts the human mind over time.

Since music mindfulness has numerous enthusiastic perspectives, it is normal that EEG checked amid music listening may demonstrate the electrical exercises of cerebrum areas connected to those angles. The outcomes may demonstrate the level of sharpness and the mind's enacted region amid music tuning in. It is anticipated that this methodology will give another viewpoint on intellectual musicology.

Numerous neurons found in the human brain play a crucial role in regulating how the body behaves while interacting with the outside world. As information carriers between the human body and the mind, these neurons will function. Thoughtful subjective conduct of the mind should be imaginable by breaking down pictures from the cerebrum on the basis of flag frequencies. Human behavior can be visualized in terms of motor and sensory states such as, such as the development of the eyes, the lips, the recognition and consideration of others, the holding of hands, and so forth. These states are connected with particular flag frequencies which help to comprehend utilitarian aspects intricate mental architecture. Electroencephalography is a powerful technique which gets personality signals identifying with various states from the scalp's surface area. Based on flag frequencies ranging from 0.1 Hz to more than 100 Hz, these signs are typically organised as delta, theta, alpha, beta, and gamma.

The mind is the most critical useful organ of the human body controlling and organizing every one of the nerves and muscles. The human cerebrum is isolated into two halves of the globe, specifically, Left Hemisphere and Right Hemisphere [6]. These two sides of the equator are additionally isolated into four flaps each, specifically, Frontal, Temporal, Parietal and Occipital projections. These four lobes in both Left and Right Hemisphere are responsible for learning, understanding, sensing, behaving and all other actions performed by the Human Body [7] [8] [9].

Electroencephalography is the technique that reads the electrical signals of the brain and measures them using a device called Electroencephalogram (EEG). The gadget includes cathodes, conductive gel, speakers and Analog to Digital Converter. These anodes are utilized to read electrical action from the scalp of the cerebrum.

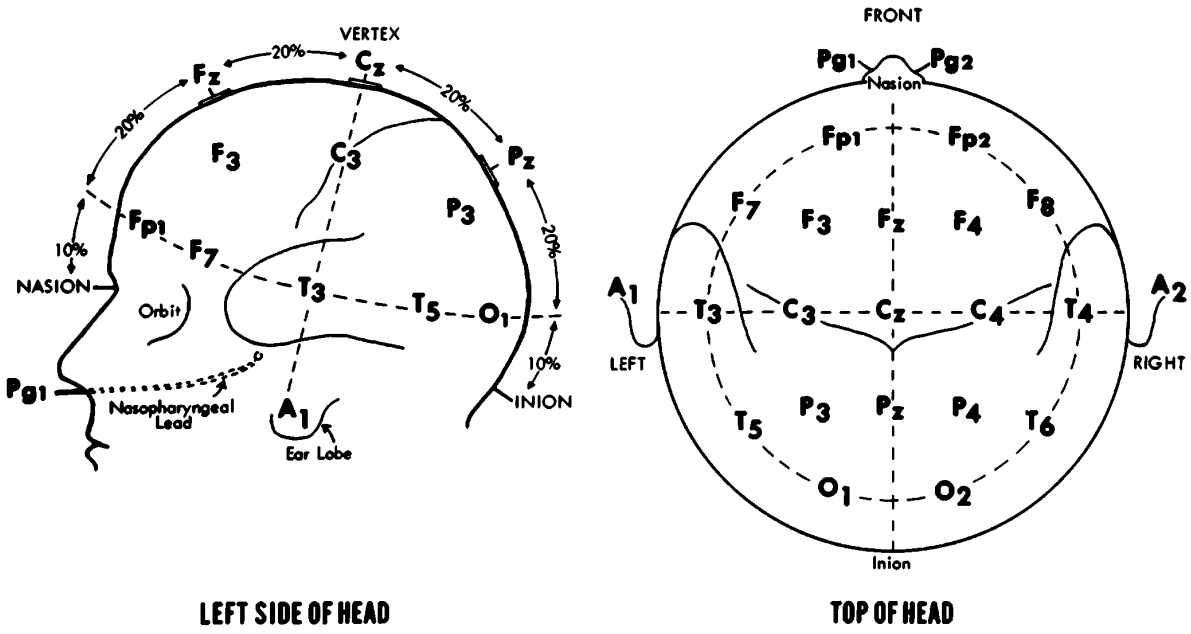

Figure 5. International 10-20 Electrode Placement System.

The electrodes are placed according to 10-20 standards of EEG placement [10]. The 10-20 electrodes just estimates the separation between promptly identifiable spots on the head and after that finds anode positions at 10 percent or 20 percent of that separation in a front back or transverse bearing as shown in Figure 5. Electrodes at that point are assigned by a capitalized letter meaning the mind locale underneath that cathode and a number, with odd numbers utilized for the left side of the equator and with even numbers implying the correct half of the lobe.

3. Objectives of Study

1. Study and analyze how the human mind encodes and recognizes music.
2. Studying the impact of digital music, on human brain and how musical experience affects brain development.
3. To compare the impact of fractal music and digital music on the human brain/mind.
4. Suggesting the material type to be used for making the instruments which can replace digital instruments for creating music.

4. Methodology to be adopted

The impact of Indian music on the human brain, in digital form and natural form, will be studied and compared. This will require the use of an Electroencephalogram (EEG) to record the brain signals of human subjects. Which signals are beneficial for the brain and which are harmful, will be declared on the basis of analysis done on the recorded brain signals.

Further, the positive effect of the natural music and the negative effect of digital music will be demonstrated by using EEG comparison on various subjects.

5. Expected Outcome of the Research

A detailed study comparing the impact of artificial/un-natural/digital signals and natural/fractal signals will make it clear how these digital/un-natural signals are hampering the human brain.

The technical impact will be the determination of fractal signals as the signals which are congenial to the human mind. These are the signals produced by various Indian musical instruments. This will also concretize the fact that digital musical instruments are more harmful for the brain than being congenial. Thus, this will prove that Indian music is green whereas digital music is unnatural and artificial.

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